Summaries

UDC 536.46:532.517.4

Askarova A.S., Gorokhovski M.A., Ryspaeva M.Zh., Voloshina I.E.
NUMERICAL SIMULATION OF COMBUSTION AND SELF-IGNITION OF TWO-PHASE CHEMICALLY REACTING FLOWS WITH INJECTIONS

Injection dispersion and influence of liquid fuel injection mass on self-ignition and burning in a combustion chamber have been studied on the basis of solution of differential equations of turbulent reacting flow. Drop size and average temperature field distributions at burning fuel with various initial mass were obtained. Global model of chemical reactions considering soot formation at liquid fuel combustion was used in the work.

UDC 621.181-192

Zavorin A.S., Taylasheva T.S.
THERMOPHYSICAL FEATURES OF EVAPORATING ELEMENTS SECURITY IN TWO-DRUM BOILERS

The results of studying the faulty pipes physical state of boiler warming radiant surfaces and furnace medium numerical simulation have been introduced. The set up complete correspondence of defect zone and area of intensive heat flux is the methodological base for predicting potentially unreliable sections of screens and working out the corrective constructive decisions.

UDC 621.182

Lebedev B.V., Zavorin A.S.
COAL MINERAL MATTER DISTRIBUTION IN HORIZONTAL BUSHY LOW-TEMPERATURE FLAME

The results of experimental investigation of the processes in a low-temperature swirling-type furnace functioning by millless technology of burning brown coal have been introduced. The specific character of forming the flame mineral ballast under the influence of aerodynamic and temperature conditions of furnace process was determined.

UDC 536.244

Drobchik V.V., Shilyaev A.M., Volokitin G.G.
STUDYING THE SWIRL AIR FLOW CHARACTERISTICS AT THE OUTPUT OF THE MODEL OF PULVERIZED-COAL SWIRL BURNER

Investigation of dynamic characteristics of swirl air flow at the output of the experimental model of pulverized-coal swirl burner has been introduced. The intensity of mixing heated uniflow stream with swirl flow cold gas was determined. It was shown that at the ratio of air consumption through the ignition channel to the external swirl flow lower than 0,3 the area of reverse flows is direct at the output of the pulverized-coal swirl burner.

UDC 621.43:068.4

Kuleshov V.K., Brazovskiy V.V., Ivzhenko O.O.
TEST BENCH FOR CONTROLLING SPUTTERING PARAMETERS AT FUEL NOZZLE OPERATION

The test bench allowing studying the sputtering process parameters has been developed. The holographic detection of spray fuel drops at operation of fuel nozzle of diesel engine A-01 in various modes was carried out. Disperse flow rate, particle size and relation of these parameters with pressure in a fuel line and rotation frequency of a shaft of high pressure fuel pump were studied.

UDC 621.43:068.4

Kuleshov V.K., Brazovskiy V.V., Baranov V.A.
CONTROL OF COMBUSTION PRODUCT PARAMETERS IN FILTRATION DEVICES

The parameters of diesel engine exhaust gases in filter chambers have been studied by the method of multichannel probing. Soot parameters were recorded by holographic device with control of gas temperature and chemical composition with further computer result processing. It was established that oxidizer excess in filter reactor, exhaust back pressure and filter porosity influence considerably the particle filtration process. It was shown that the exhaust gas temperature increases after filters, that indicates the exothermic reactions in porous wall.

UDC 621.643.001:536.2

Loginov V.S., Polovnikov V.Yu., Kravchenko D.K., Ryabichev T.V.
EXPERIMENTAL INVESTIGATION OF HEAT PIPELINE THERMAL CONDITIONS AT INSULATION MOISTENING

Heat pipeline thermal loss at flooding and thermal insulation drying after channel draining has been experimentally determined. The scales of thermal loss were established and duration of drying the heat pipeline insulation used at insulation moistening was determined.

UDC 66.011

Belyanin A.V., Nagaitseva O.V., Liventsova N.V., Liventsov S.N.
DEVELOPMENT OF THE MODEL OF ELECTROLYZER THERMAL PROCESS FOR SIMULATOR OF INDUSRTIAL CONTROL OPERATOR OF FLUORINE PRODUCTION

Mathematical description of thermal model of medium-temperature electrolyzer (STE-20) for computer simulator of fluorine production operator has been introduced. The results of numerical experimant carried out for estimation of model operation quality in the range of the model variable values corresponding to STE-20 normal conditions were introduced.

UDC 621.311.12

Khizhnyakov Yu.N.
STRESS VECTOR FORMATION ON BUSES OF ISOLATED GENERATING ELECTRIC STATION

Questions of stress vector formation on buses of parallel operation of synchronous generators at isolated generating electric station and calculation of load current for each generator have been considered. It allows constructing mathematical models of isolated generating electric stations and studying them from idle mode to short-circuit conditions. Synchronous generator in the system is introduced as a source of electromotive force with internal resistance through the Park-Gorev equation in modification of L.P. Veretennikov.

UDC 621.311.004.13

Fishov A.G., Kasobov L.S.
STATEMENT OF THE PROBLEM OF CONTROLLING TRANSIENT STATES FOR PROVIDING STABILITY OF NUREKSKAYA HPS BY SWITCHING OFF THE GENERATORS

Control algorithm for preventing instability by switching off the HPS generators determining a number of switched off generators in rate of the process and estimation of static stability factors in real time has been proposed. The data of synchronized process recording on buses of electric stations of Tajikistan power system were used.

UDC 53.01

Lavrinovich M.V.
CONDITIONS OF ELECTRIC ARC STARVATION IN THE AIR

Influence of conditions of electric arc starvation in the air has been carried out for application of the determined characteristics in the design models of intermittent arcs in networks with insulated neutral. It was found out that the amplitude of the last current half-wave at which the arc still burns does not depend on field nonuniformity between electrodes. The dependence of half-wave amplitude of the cutoff current on current vibration frequency was experimentally determined. In the air, as well as in vacuum (pressure less than 10^{-3} Pa) the current break phenomenon is observed. It occurs at current approaching to zero value. In the case of unsuccessful electric arc starvation the dead time may change in rather wide range and achieve the values up to 1 ms.

UDC 621.34+661.879

Boyko S.V., Kladiev S.N.
APPLICATION OF VARIABLE-FREQUENCY ELECTRIC DRIVE FOR INCREASING RELIABILITY OF LOAD NODE OF FLAME REACTOR

A method of synthesis of control with the pulse-width modulation, based on formation of controlling action on balance of the energy necessary and saved up in the system is offered. Algorithm of formation of control by the pulse voltage converter and the results of research of the system in various operating modes are resulted.

UDC 621.313.2

Smirnov A.O., Langraf S.V., Kazakov V.S., Bekishev R.F.
STUDYING STATIC MODES OF OPERATION OF FREQUENCY-CONTROLLED ASYNCHRONOUS DRIVE AT LOW TEMPERATURES

Frequency-controlled asynchronous drive of stop valve at various environment temperatures has been studied. Temperature influence on electric drive mechanical characteristics was shown. Simulation model considering temperature influence on operation of electric drive elements was proposed.

UDC 621.316.79:621.313.333

Semykin I.Yu., Zavyalov V.M., Glazko M.A.
GRADIENT CONTROL OF MULTIMOTOR ASYNCHRONOUS DRIVE

Features of controlling electromagnetic torques of induction motors included into multimotor electric drive have been shown. The researches of influence of one motor parameter deviation on a total moment of multimotor electric drive are introduced. On the basis of high-speed gradient technique the method of controlling such electric drive is proposed and control indices are considered. Working capacity of the proposed control mode considering frequency converting features is shown. References on selecting the method of gradient controlling the multimotor electric drive are given.

UDC 621.313.333

Beierlein E.V.
JUSTIFICATION OF APPLYING A POWER SAVING CIRCUIT OF TESTING LARGE INDUCTION DRIVES

A back-to-back circuit for testing large induction traction motors has been developed. It allows saving electric energy at testing and may be used at test stations of large electric machines of rolling stock.

UDC 621.313.333

Tyuteva P.V.
ALGORITHM OF ESTIMATING EFFICIENCY OF INDUCTION MOTOR OPERATION IN PUMP UNITS

The algorithm of estimating efficiency of induction motor operation included into controlled electric drive of pump units considering various control laws has been proposed. It includes data input, design of energy and economic pump characteristics with further data processing. Algorithm originality consists in joint design of energy and economic part of energy saving induction motor that allows estimating economic efficiency of motor operation.

UDC 621.313.32

Shishkov N.V.
DETERMINING PARAMETERS OF DIRECT CURRENT MOTOR WITH SERIES EXCITATION ON THE BASIS OF TECHNIQUE OF QR DECOMPOSITION

The method of determining the main parameters of the direct current motor with series excitation using the technique of QR decomposition has been considered. Relative errors in determining electric parameters of electric motors with different power are shown.

UDC 621.313.32

Kibartene Yu.V.
SYNCHRONOUS MOTOR WITH A FIXED ROTOR AS AN OBJECT OF IDENTIFYING ELECTRIC PARAMETERS

Synchronous motor has been considered as an object of identification. Mathematical description of synchronous motor in state space is introduced. It was assigned that synchronous motor is controllable, observable and identifiable object. It was concluded that the known parametric identification methods may be applied to the synchronous motor for determining its parameters.

UDC 534.6.08

Soldatov A.I., Chiglintseva Yu.V.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF ACOUSTIC TRACT OF BOREHOLE DEPTH GAUGE

The acoustic tract of borehole depth gauge has been analyzed. The method of two comparators for determining the moment of coming of acoustic pulse reflected from the hole bottom was proposed that allows increasing the accuracy of depth measuring in 2...3 times.

UDC 535.211

Kanev F.Yu., Rychkov D.S.
ANALYSIS OF DISTORTION COMPENSATION BY A BACK SCATTERING SIGNAL CARRIED OUT SUBJECT TO RESTRICTIONS INTRODUCED BY ADAPTIVE MIRROR

The results of numerical simulation of performance of laser system adaptive circuit including flexible mirror have been proposed. In order to calculate the reflecting surface deformations the finite element method was used. Simulation of partially coherent radiation propagation and its back scattering in atmosphere was carried out on the basis of parabolic equation solution by the method of physical factor splitting. It was shown that restrictions introduced by the mirror do not result in considerable decrease in efficiency of laser beam distortion correction.

UDC 537.856

Vladimirov S.N., Zeman S.K., Ruban V.V.
ALGORITHM OF STUDYING IMPEDANCE CHARACTERISTICS OF INDUCTION HEATING SYSTEM OF TOOL AND STRUCTURAL STEELS AT VARIATIONS OF TEMPERATURE AND INPUT POWER

On the basis of using two-dimensional analytical functional approximating temperature-field dependence of structural and tool steel permeability the algorithm of studying electrophysical parameters of induction heating system in the wide range of temperatures and decreasing power densities has been constructed. The efficiency of the algorithm is shown by model analysis.

UDC 537.856

Vladimirov S.N., Zeman S.K., Ruban V.V.
ANALYTICAL RELATIONS APPROXIMATING TEMPERATURE-FIELD DEPENDENCE OF STRUCTURAL STEEL PERMEABILITY

The dependence of relative permeability of steels with temper 0,5...1,0 % on magnetic field strength 0...640 kA/m and temperature 0...800 °C has been approximated.

UDC 621.314

Zeman S.K., Kazantsev Yu.M., Osipov A.V., Yushkov A.V.
FORMATION OF DUAL-FREQUENCY CURRENT OSCILLATIONS IN INDUCTION HEATING SYSTEMS

The issues of synthesizing dual-frequency oscillations in induction heating systems have been studied. It was shown that application of dual-frequency resonant circuit which allows forming inducer current harmonics in resonant mode is efficient. Amplitude-frequency characteristics of the system using which the current harmonics ratio may be assigned by the circuit parameters were determined. Versatility and wide range of application of harmonic synthesis method in induction heating is the practical result of the work.

UDC 621.314

Murkin M.N., Zeman S.K., Yaroslavtsev E.V.
STUDYING SWITCHING PROCESSES IN CURRENT INVERTER

Switching processes and control modes of parallel inverter with quasi-resonant switching for induction heating have been considered. Optimal switching algorithm of power keys which allow minimizing voltage jumps at circuit elements was proposed. Using CAD OrCad 9.2 the influence of erection stray inductance in high frequency link of converter on transients was studied. It was shown that the results of simulation and the experiment coincide with accuracy of 10 %.

UDC 621.314.58

Ogorodnikov D.N., Yaroslavtsev E.V., Grebennikov V.V.
POWER SUPPLY OF ASYMMETRIC CURRENT DRIVER

Power supply for quasi-sinusoidal asymmetric current driver used in electrochemical technologies has been described. The device provides the set-up parameters of output voltage in the wide range of changing load and frequency resistance. Nominal capacitance of load is 2,5 kW; output voltages are 250, 50 and 300 V; power is supplied from a three-phase network 380 V±10%, 50...60 Hz.

UDC 621.314.57

Ogorodnikov D.N., Yaroslavtsev E.V.
ANALYSIS OF A SINGLE-PHASE PARALLEL RESONANCE INVERTER WITH CONSTANT QUASI-SINUSOIDAL OUTPUT VOLTAGE

The independent single-phase parallel resonance inverter has been analyzed. The analytic expressions describing the laws of changing inverter voltages and currents were obtained. The inverter parameter dependences on oscillating circuit Q-factor were ascertained. Regulating characteristics for the circuit with output voltage stabilization at destabilizer action were determined. The obtained expressions allow carrying out engineering design of the elements of resonance inverter strength part, evaluating their mass and sizes.

UDC 621.316.722

Kazantsev Yu.M., Lekarev A.F.
CONTROL IN SYSTEMS WITH PULSE-WIDTH MODULATION ON BALANCE OF THE SAVED UP AND NECESSARY ENERGY

A method of synthesis of control with the pulse-width modulation, based on formation of controlling action on balance of the energy necessary and saved up in the system is offered. Algorithm of formation of control by the pulse volt

UDC 629.78.01

Gordeev K.G., Ostapuschenko A.A., Galayko V.N., Volkov M.P.
SYSTEMS OF FEED AND CONTROL OF ELECTROJET PROPULSION DEVICES OF AUTOMATIC SPACECRAFTS

Systems of feed and control of electrojet propulsion devices on the basis of stationary plasma engines for correcting spacecraft orbit have been considered. The diagram and algorithms of controlling electrojet propulsion devices are described. The main characteristics of feed and control systems developed in «Research and development center «Polyus» including those intended for maintaining without spacecraft pressurized section were introduced.

UDC 539.293;621.382

Paraschuk V.V., Belyaeva A.K., Baranov V.V., Telesh E.V., Vu Doan Mien, Vu Van Luc, Pham Van Truong
OPTIMIZATION OF DIODE LASER THERMAL CONDITIONS

Chemical and vacuum methods of forming metal coats with high adhesion to various surfaces on the basis of multifunctional ion-beam and magnetron spraying systems and with respect to copper and diamond heat sink bases for diode lasers were developed. Optimal conditions of assembling diode lasers and bars on the basis of the developed metallization methods were determined and significant improvement of the device output characteristics was achieved.

UDC 621.373.826

Evtushenko G.S., Gubarev F.A., Sukhanov V.B., Shiyanov D.V., Torgaev S.N., Trigub M.V.
HIGH-SPEED VISUALIZATION OF MICROSCOPE OBJECTS BY ACTIVE MEDIA OF METAL-VAPOR LASERS AT BACKGROUND LIGHT

Analysis of possibility of developing and using active optical systems for visualization of macro- and microscope objects at background light including the real-time mode has been introduced. The results of developing and testing such system model using active medium of high-frequency copper bromide vapor laser are introduced. The process of self-propagating high-temperature synthesis was visualized. A number of experiments on bio-object visualization, as well as at ambient light, was carried out.

UDC 621.373.8

Gubarev F.A., Fedorov V.F., Evtushenko G.S., Trigub M.V.
CONTROL OF CuBr-LASER GENERATION

A possibility of generation controlling of CuBr-laser with solid-state switch by changing of excitation pulse form has been shown. Formation of supplementary pre-pulse of low amplitude or distortion of pumping pulse rising edge allows decreasing energy in generation pulse both partially and to complete supression.

UDC 621.373.826

Dimaki V.A., Sukhanov V.B., Troitskiy V.O., Filonov A.G.
A COPPER-BROMIDE VAPOR LASER WITH TEMPERATURE STABILIZATION OF ACTIVE VOLUME WALLS

The influence of thermal regime on the energy characteristics of the copper bromide vapor laser radiation has been investigated under conditions of temperature stabilization of active volume walls using an independent of a discharge power source. The characteristics of laser operation in the input power range 160...1500 W are introduced. The influence of bromhydrogen additions on the generation parameters is shown.

UDC 621.375.8

Fedorov A.I.
HIGH-PRESSURE DISCHARGE LASERS DESIGNED IN IAO SB RAS

The paper describes the history of the development of the first lasers in Tomsk by the graduating students of the Tomsk Polytechnic University and the Tomsk State University on the basis of the Zuev Institute of Atmospheric Optics SB RAS. The parameters as well as the characteristics of excitation of high pressure discharge lasers with UV-reionization in active media of high-pressure of N_2, CO_2, Cu and excimer molecules are given. In Tomsk one of the first in the world Cu-vapor lasers with a transverse excitation discharge and with pulse generation of Cu vapors owing to conductor explosion was developed. This laser was used when obtaining the record specific generation parameters: the radiation energy of 2,4 J/l, the peak power of 120 MW/l at the laser efficiency of 0,16 %. A compact nitrogen laser with the maximum efficiency of 0,27 %, the pulse energy of 0,8 mJ, the peak power of 160 kW and the pulse repetition frequency up to 40 Hz was first designed in Russia.